SATA M.2 Test Adapter

User Manual

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Introduction

This user's guide documents the SATA M.2 Host and Device Test Adapters (SATA M.2-TPA-P and SATA M.2-TPA-R, respectively) and the associated Calibration Module. The two test adapter types, shown in Figures 1 and 2, test SATA M.2 interface cables, hosts and devices against the SATA Specification 3.0. The Calibration Module, shown on Page 12, is used to zero-out test adapter attributes (using SOLT, with either the 1X-THRU or the 2X-THRU).

The TPA-P and TPA-R test adapter assemblies allow easy access, via SMA connections, to measure or inject data signals. The Receptacle test adapter also provides input access to +3.3V, and their respective GNDs, via a 4-position input power connector. Additionally, a 12-position low-speed connector is provided for access to commonly used low-speed signals. Mating 4-position and 12-position connector housings and contacts are provided to connect the above power supplies to a wiring assembly provided by the user.

NOTE: To avoid damaging the cables, use the handling techniques described in the Care and Handling section before making any connections or configuring a test setup.

Always use a static-safe workstation when performing tests, as explained in the "Electrostatic Discharge Information" section.

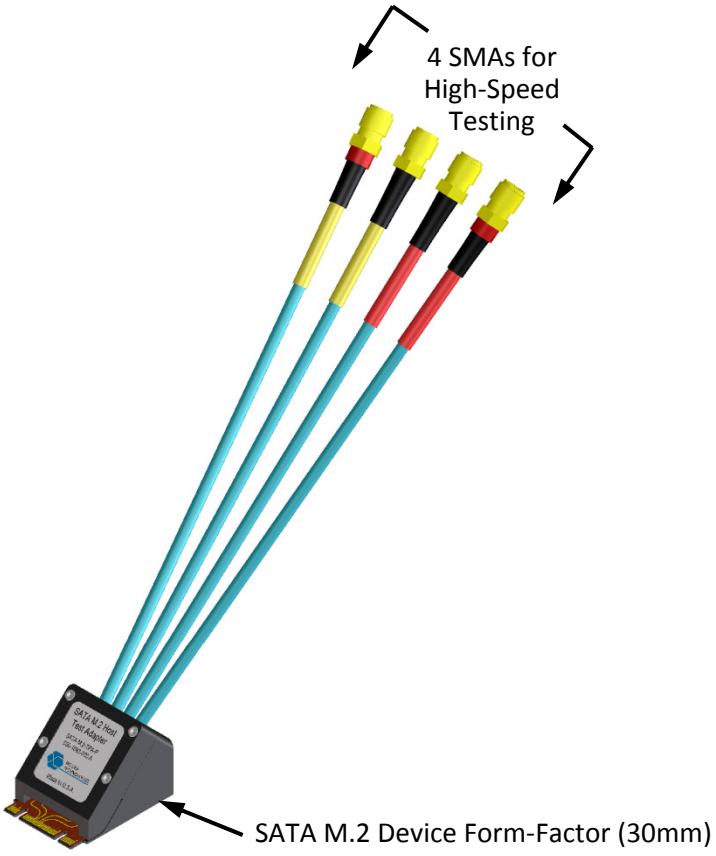

Figure 1. The SATA M.2 Host Test Adapter (Plug)

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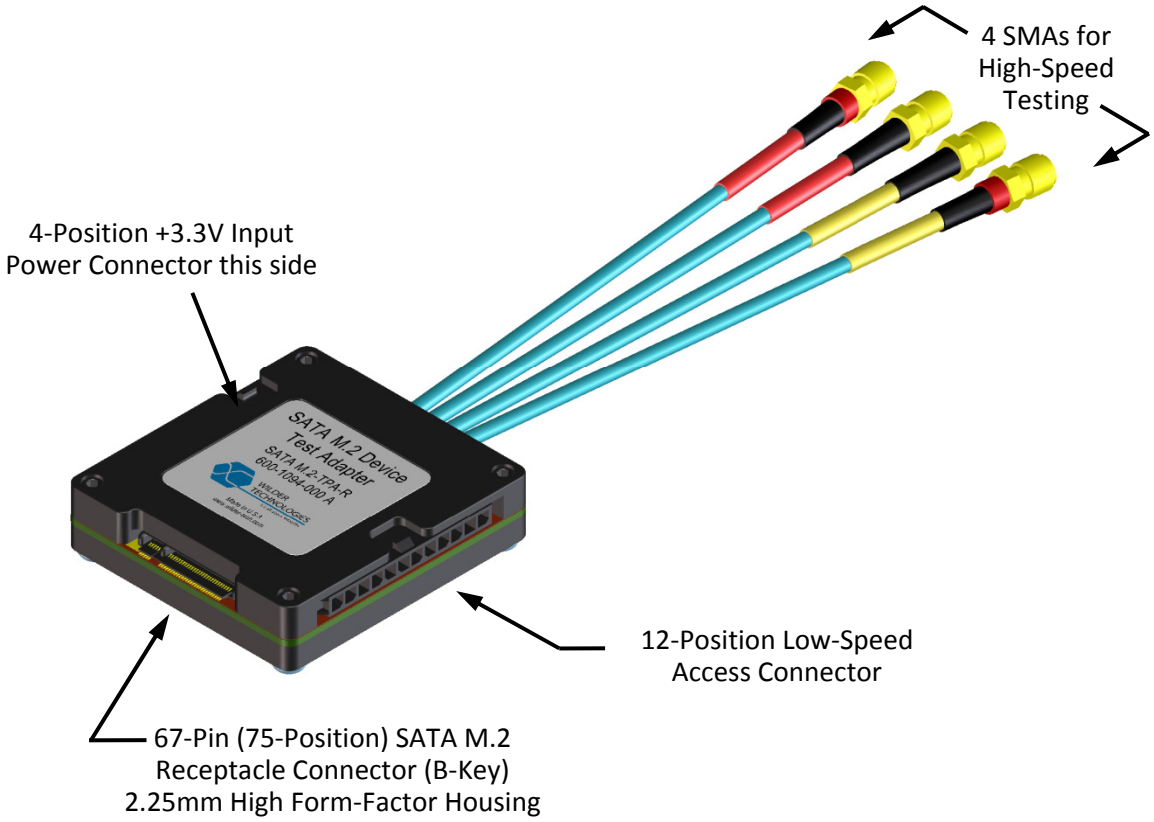

Figure 2. The SATA M.2 Device Test Adapter (Receptacle)

The 4-position input power connector used in the receptacle test adapter is Molex part number 43650-0404. The 12-position low-speed connector is Molex part number 43650-1204. The mating receptacle connector housings and contact pins for 26-30awg wire are provided with each SATA M.2-TPA-R assembly (Molex part number 43645-0400 for the 4-position input power connector housing, 43645-1200 for the 12-position low-speed connector housing, and 43030-0011 for the 26-30awg pin contacts). Replacement receptacle housings or contacts can be purchased through Molex distributors.

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Product Inspection

Upon receiving the SATA M.2-TPA from Wilder Technologies, perform the following product inspection:

- Inspect the outer shipping container, foam-lined instrument case, and product for damage. Retain the outer cardboard shipping container until the contents of the shipment have been inspected for completeness and the product has been checked mechanically and electrically. Use the foam-lined instrument-case for secure storage of the Wilder Technologies SATA M.2 Test Adapter when not in use.

- Locate the shipping list and verify that all items ordered were received.

- In the unlikely event that the product is defective or incomplete, the “Limited Warranty” section discusses how to contact Wilder Technologies for technical assistance and/or how to package the product for return.

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The SATA M.2 Test Adapter Care and Handling Precautions

The SATA M.2 Test Adapter requires careful handling to avoid damage. Improper handling techniques, or using too small a cable bend radius, can damage the coaxial cable connections within the adapter housing or the cables themselves. This can occur at any point along the cable. To achieve optimum performance and to prolong the SATA M.2-TPA's life, observe the following handling precautions:

- **CAUTION 1: Avoid Torque Forces** (Twisting)
  While individual coaxial cables within the test adapter have some rotational freedom, twisting the SATA M.2-TPA as a unit, with one end held stationary, may damage or severely degrade performance. Adherence to Caution 5 (below) helps to avoid twisting.

- **CAUTION 2: Avoid Sharp Cable Bends**
  Never bend coaxial cables into a radius of 26 mm (1-inch) or less. Never bend cables greater than 90°. Single or multiple cable bends must be kept within this limit. Bending the SATA M.2-TPA cables less than a 26mm (1-Inch) radius will permanently damage or severely degrade test adapter performance.

- **CAUTION 3: Avoid Cable Tension** (Pull Forces)
  Never apply tension (pull forces) to an individual coaxial cable that is greater than 2.3 kg (5 lbs.). To avoid applying tension, always place accessories and equipment on a surface that allows adjustment to eliminate tension on the SATA M.2-TPA and cables. Use adjustable elevation stands or apparatus to accurately place and support the SATA M.2-TPA.

- **CAUTION 4: Connect the SATA M.2-TPA First**
  To prevent twisting, bending, or applying tension to the coaxial cables when connecting a SATA M.2-TPA, always attach the SATA M.2-TPA to the device under test (DUT) or cable under test before attaching any SMA connectors. Carefully align the SATA M.2 connectors and then gently push the connectors together until fully seated (see also Caution 7).

  If the SATA M.2-TPA must be turned or twisted to make connection to the DUT, avoid using the SATA M.2-TPA housing alone to make this occur. Try to distribute the torque forces along the length of the test setup and cabling. If this is not possible, it is recommended to first loosen or disconnect the SMA connections at the SATA M.2-TPA, make the connection to the DUT and then re-tighten or attach the test equipment leads.

NOTE: Only grip the test adapter housing when inserting or extracting the SATA M.2-TPA to or from the DUT. Pulling directly on the SATA M.2-TPA cables or using them to insert the SATA M.2-TPA may cause damage.

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- **CAUTION 5: Carefully Make SMA Connections**
  To connect the SATA M.2-TPA SMA connectors, follow these steps:

  1. Hold the cable stationary by grasping the cable at the black heat-shrink section near the SMA connector.

  2. Insert the mating SMA barrel and hand-tighten the free-spinning SMA nut onto the connector while avoiding pulling, bending, or twisting the SATA M.2-TPA coaxial cable.

  3. The SATA M.2-TPA SMA connectors have flats that accept an open-end 1/4-inch or 6.5mm wrench. When attaching instrument cables to the SATA M.2-TPA, it is recommended that the SATA M.2-TPA SMA connectors be mechanically held and the test leads be tightened to the equipment manufacturer's torque recommendations, normally 5 in-lbs, using a 5/16-inch open-end wrench.

If the test set-up requires repositioning, first loosen or disconnect the SMA connections to avoid twisting, bending, or tension.

NOTE: A drop in signal amplitude by half or 6db during the testing of a channel may indicate that a cable has been mechanically pulled free of coaxial cable connections internal to the assembly. This could be determined by checking if the cable has any lateral play relative to the TPA. This would only occur when the TPA has exceeded the pull force as specified within the mechanical specification. If the cable cannot be re-seated, the test adapter will need to be sent back to the factory for service.

- **CAUTION 6: Independently Support Instrument Cables or Accessories**
  Excessive weight from instrument cables and/or accessories connected to the SATA M.2-TPA can cause damage or affect the test adapter performance. Be sure to provide appropriate means to support and stabilize all test set-up components.

- **CAUTION 7: Observe SATA M.2 (NGFF) Mini-Card Module Insertion/Removal Instructions**
  Users that are unfamiliar with the SATA M.2 (NGFF) connector interface and the associated module (device or TPA) insertion and removal process are encouraged to review Tyco Electronics document 114-115006, Section 3.13 for guidance (see link, below and the extracted guideline section on the following page).

  http://www.te.com/commerce/DocumentDelivery/DDEController?Action=showdoc&DocId=Specification+Or+Standard%7F114-115006%7FA%7Fpdf%7FEnglish%7FENG_SS_114-115006_A.pdf%7FN-A

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- **CAUTION 7 (Continued): SATA M.2 (NGFF) Mini-Card Module Insertion/Removal Instructions Extracted from Tyco Electronics Application Note 114-115006.**

3.13. Module Insertion and Removal Process

A. Module Insertion Process for 2.25H, 3.2H, and 4.2H

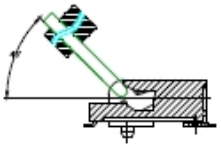

Fig. 6.1

Step 1st: Move the module against the housing's chamfer See (Fig. 6.1).

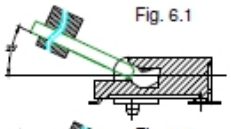

Fig. 6.2

Step 2no: Rotate module to 25° (Fig. 6.2) and insert it until module bottom surface reach the ramp (Fig. 6.3).

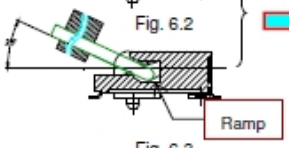

Fig. 6.3

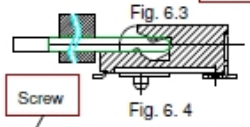

Fig. 6. 4

Step 3rd: Rotate the module to horizon by hand (Fig. 6.4).

Fig. 6.5

Step 4th: Fix the module with PCB by screw (Fig. 6.5).

B. Module Removal Process for 2.25H, 3.2H, and 4.2H

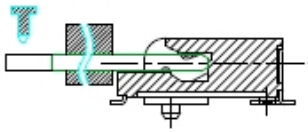

Fig. 7.1

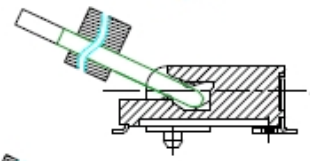

Fig. 7.2

Step 1st: Loose the screw by hand (see Fig. 7.1), and module will be rotated automatically due to connector contact's counterforce at the same time (see Fig. 7.2).

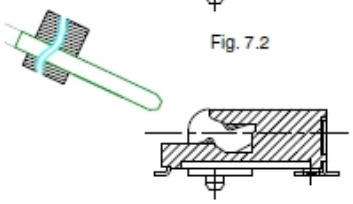

Fig. 7.3

Step 2nd: Take away the module by hand (see Fig. 7.3).

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General Test Adapter, Cable, and Connector

Observing simple precautions can ensure accurate and reliable measurements.

Handling and Storage

Before each use of the SATA M.2-TPA, ensure that all connectors are clean. Handle all cables carefully and store the SATA M.2-TPA in the foam-lined instrument case when not in use, if possible. Do not set connectors contact end down. Install the SMA protective end caps when the SATA M.2-TPA is not in use.

Visual Inspection

Be sure to inspect all cables carefully before making a connection. Inspect all cables for metal particles, scratches, deformed threads, dents, or bent, broken, or misaligned center conductors. Do not use damaged cables.

Cleaning

If necessary, clean the connectors using low-pressure (less than 60 PSI) compressed air or nitrogen with an effective oil-vapor filter and condensation trap. Clean the cable threads, if necessary, using a lint-free swab or cleaning cloth moistened with isopropyl alcohol. Always completely dry a connector before use. Do not use abrasives to clean the connectors. Re-inspect connectors, making sure no particles or residue remains.

Making Connections

Before making any connections, review the “Care and Handling Precautions” section. Follow these guidelines when making connections:

- Align cables carefully
- Make preliminary connection lightly
- To tighten, turn connector nut only
- Do not apply bending force to cable
- Do not over-tighten preliminary connections
- Do not twist or screw-in cables
- Use an appropriately sized torque wrench (depends on SMA gender), and do not tighten past the “break” point of the torque wrench (normally set to 5 in-lbs)

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Electrostatic Discharge Information

Protection against electrostatic discharge (ESD) is essential while connecting, inspecting, or cleaning the SATA M.2-TPA test adapter and connectors attached to a static-sensitive circuit (such as those found in test sets).

Electrostatic discharge can damage or destroy electronic components. Be sure to perform all work on electronic assemblies at a static-safe work station, using two types of ESD protection:

- Conductive table-mat and wrist-strap combination
- Conductive floor-mat and heel-strap combination

When used together, both of these types provide a significant level of ESD protection. Used alone, the table-mat and wrist-strap combination provide adequate ESD protection. To ensure user safety, the static-safe accessories must provide at least 1 MΩ of isolation from ground. Acceptable ESD accessories may be purchased from a local supplier.

WARNING: These techniques for a static-safe work station should not be used when working on circuitry with a voltage potential greater than 500 volts.

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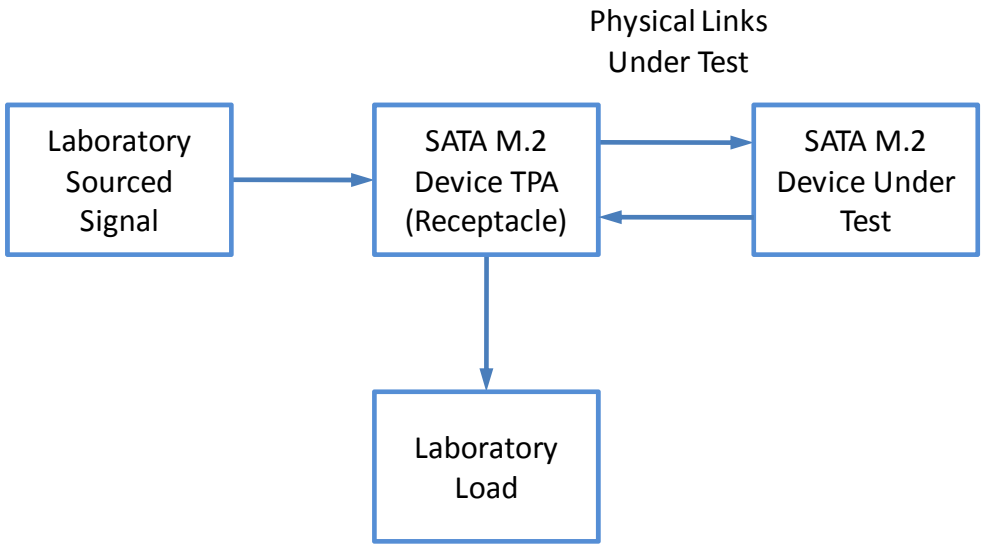
User Model

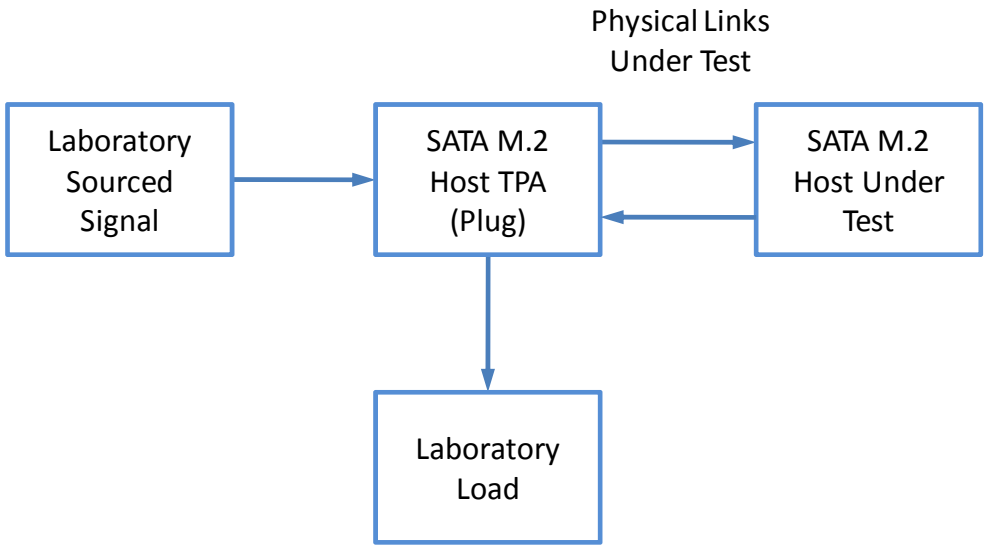
The SATA M.2 TPA supports all testing of the SATA Specification. It is capable of performing well beyond the scope of measurements required, limited only by the specifications, environmental, care and handling as stated in this document.

The following examples are suggestions for possible testing setups.

In this first example, an SATA M.2 Device (receptacle) TPA is used to test an SATA M.2 device:



The second example shows an SATA M.2 Host (Plug) TPA used to test a host:



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Calibration

The SATA M.2 Host (Plug) and Device (Receptacle) Test Adapters are passive components. Therefore, calibration for the errors generated must occur within the test instrumentation that drives the SATA M.2 target device or looks at the response of the SATA M.2 initiator device.

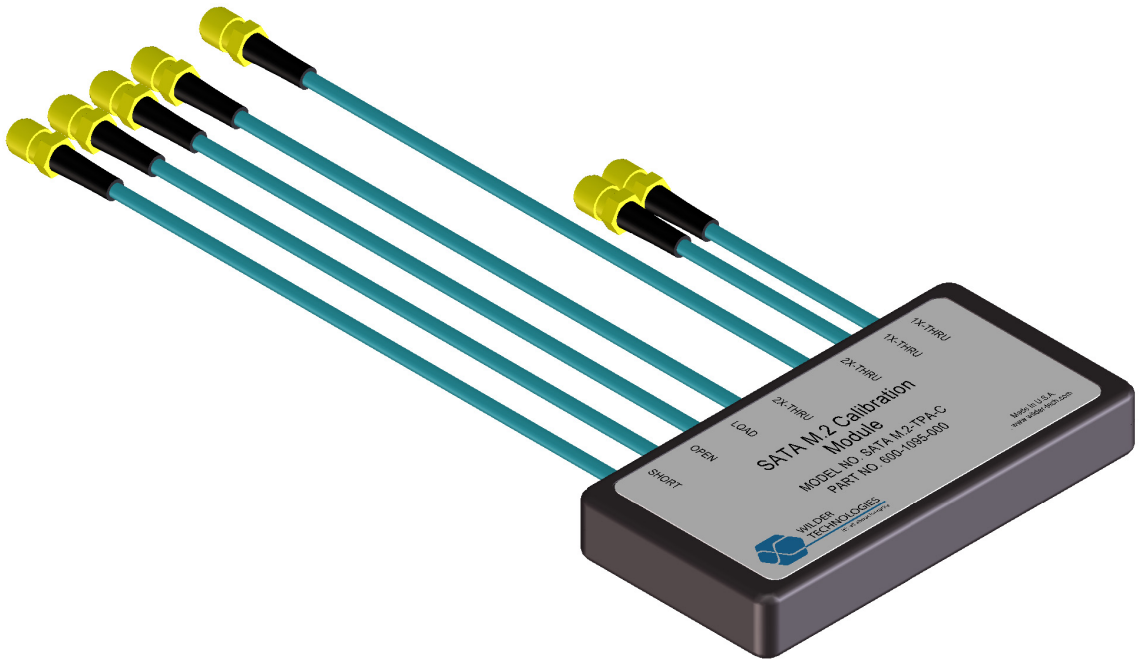

Figure 3. Calibration module (SATA M.2-TPA-C) showing standard 6-inch cable on SOLT and 3-inch cables connected to the 1X-THRU

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SOLT

SHORT, OPEN, LOAD, and 2X-THRU (SOLT) are calibration standards used to compensate for errors associated with the TPA when used for Jitter measurement, TDR, TDT, and VNA testing. SOLT represents the same electrical length and losses as the TPA through the SATA M.2 connector pad, and enables the test engineer to compensate for the following six repeatable, systematic errors that occur when moving the reference plane:

- Signal leakage effects: *Directivity errors*
- Signal leakage effects: *Crosstalk errors*
- Reflection effects: *Source Impedance Mismatching errors*
- Reflection effects: *Load Impedance Mismatching errors*
- Bandwidth effects: *Receiver Transmission in Test Equipment errors*
- Bandwidth effects: *Receiver Reflection-tracking in Test Equipment errors*

These errors need to be corrected on each port. Refer to the Instrument Manual for instructions on the instrument's specific calibration process.

NOTE: The reference plane is the boundary, both physically and electrically, between the calibrated and uncalibrated portions of the circuit. Everything outside the reference plane is considered part of the DUT. Any instrument that does not use calibration defines the DUT as the total of externally connected components. If the SATA M.2-TPA-C is not used, all of the SATA M.2-TPA and the 6-inch cables, as well as cables connecting the 6-inch cables to the test instrument, would be a part of the DUT.

Non-repeatable errors, such as drift or random errors, can be reduced but not corrected. Drift errors aggregate over time or with environmental changes such as temperature shift. To eliminate drift errors, perform another calibration.

A random error cannot be corrected through calibration since the error occurred randomly. Random errors are typically associated with either test instrument noise or test repeatability problems. Reduce test instrument noise by increasing source power, lowering the IF bandwidth, or averaging results over multiple sweeps. Reduce test repeatability problems through the use of a torque wrench or, again, by averaging over multiple sweeps.

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1X-THRU

The 1X-THRU is a calibration feature used to calibrate time domain instrumentation (for example, pre-emphasized pulse generators or AWGs, arbitrary waveform generators). 1X-THRU calibration compensates two error sources – cable losses and group delay:

- **Cable Losses** – Cable losses associated with the SATA M.2 plug TPA, and its respective cabling that's connected to the test source, consist of skin loss and, to a lesser extent, dielectric loss. Pre-emphasis or de-emphasis is used at the signal source to correct for these cable losses. Pre-emphasis is a boost of the signal level just after an edge transition; de-emphasis is a reduction in the low-speed amplitude of the signal source. Typically, on a de-emphasized signal the levels have to be reset to attain the same output levels. Resultant signals from either pre-emphasis or de-emphasis are identical relative to the DUT.

  For the purposes of this discussion, pre-emphasis will be used. To set the pre-emphasis, first determine the amount of signal boost by connecting the signal source, via the 1X-THRU and the respective cable used to connect the DUT to the source to a high-speed oscilloscope or a jitter measurement device. Trigger the oscilloscope or jitter measurement device using a trigger from the source. The trigger, a single event, indicates the start of the signal being sent to the DUT. Adjust pre-emphasis to maximize the eye opening.

- **Group Delay** – Group delay is the second error source for 1X-THRU calibration. When the DUT generates an output signal, it can be used to measure delay. To create a baseline delay measurement, connect the output signal cable to the input signal cable and the 1X-THRU. To determine corrected DUT delay, subtract this baseline measurement from the DUT delay measurements.

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Calibration Through De-Embedding

The SATA M.2 Host and Device Test Adapters are fully passive components. Therefore, calibration compensating for the losses must occur within the test instrumentation that drives the SATA M.2 receiver device or looks at the response of the SATA M.2 transmitter device.

The SATA M.2-TPA's have Touchstone S4P files for de-embedding the electrical length and losses within the TPA up to the SATA M.2 connector interface pads. (Contact Wilder Technologies, support@wilder-tech.com, to obtain a copy of the S4P files.) The Touchstone S4P files enable the test engineer to compensate for the following six repeatable, systematic errors that occur when moving the reference plane:

- Signal leakage effects: *Directivity errors*
- Signal leakage effects: *Crosstalk errors*
- Reflection effects: *Source Impedance Mismatching errors*
- Reflection effects: *Load Impedance Mismatching errors*
- Bandwidth effects: *Receiver Transmission in Test Equipment errors*
- Bandwidth effects: *Receiver Reflection-tracking in Test Equipment errors*

These errors are corrected on each port. Refer to the Instrument Manual for instructions on the instrument's specific de-embedding process.

NOTE: The reference plane is the boundary, both physically and electrically, between the calibrated and uncalibrated portions of the circuit. Everything outside the reference plane is considered part of the DUT. Any instrument that does not use calibration or de-embedding of the test fixture defines the DUT as the total of externally connected components. If the de-embedding file is not used, all of the SATA M.2-TPA and associated coaxial cables, as well as cables connecting the TPA assembly to the test instrument, would be a part of the DUT.

Non-repeatable errors, such as drift or random errors, can be reduced but not corrected. Drift errors aggregate over time or with environmental changes such as temperature shift. To eliminate drift errors, perform an instrumentation-level calibration.

A random error cannot be corrected through calibration since the error occurred randomly. Random errors are typically associated with either test instrument noise or test repeatability problems. Reduce test instrument noise by increasing source power, lowering the IF bandwidth, or averaging results over multiple sweeps. Reduce test repeatability problems through the use of a torque wrench or, again, by averaging over multiple sweeps.

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Mechanical and Environmental Specifications

NOTE: All specifications in this manual are subject to change.

Table 1. General Specifications

ITEM	DESCRIPTION
Usage Environment	Controlled indoor environment
Host Test Adapter Length (w/ std. cables)	169.4mm +/- 2mm (6.67 inches +/- .08 inches) (Characteristic)
Device Test Adapter Length (w/std. cables)	179mm +/- 2mm (7.05 inches +/- .08 inches) (Characteristic)
Operating Temperature	0°C to +55°C (32°F to +131°F) (Characteristic)
Storage Temperature	-40°C to +70°C (-40°F to +158°F) (Characteristic)

SATA M.2-TPA-R Cable Pinout

The SATA M.2-TPA-R cables provide four SMA connectors (one lane of primary differential RAand TB), one 4-position input power connector, and one 12-position connector containing the low-speed signals. Labels clearly mark each cable or connector. The following figure refers to pin-description tables for each of the three connector types. Note: The input power supply (3.3V) has a 22µF in parallel with two-each 0.01µF capacitors.

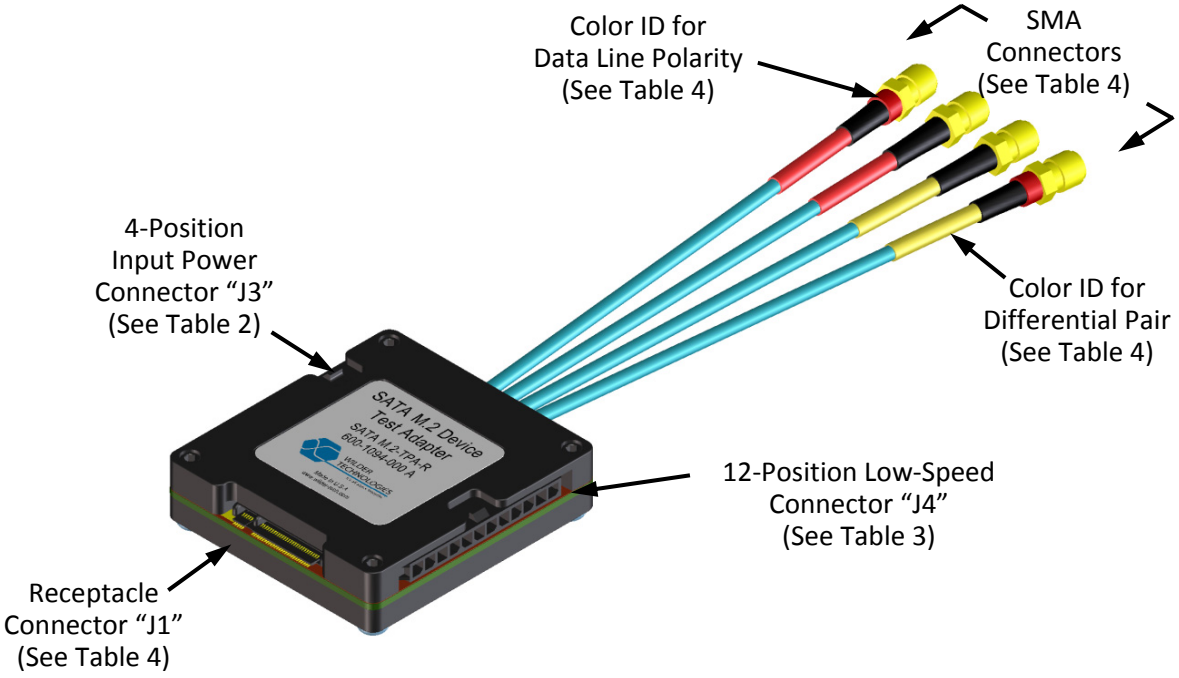

Figure 4. Cable Connectors (SATA M.2-TPA-R shown)

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Table 2. SATA M.2-TPA-R 4-Position Input Power Connector "J3"

LABEL	PIN NO.	DESCRIPTION
GND	Pin 1	Ground
+3.3V	Pin 2	+3.3 Volts
+3.3V	Pin 3	+3.3 Volts
GND	Pin 4	Ground

Table 3. SATA M.2-TPA-R 12-Position Low-Speed Connector "J4"

LABEL	PIN NO.	DESCRIPTION
GND	Pin 1	Ground
CFG0	Pin 2	Configuration 0
CFG1	Pin 3	Configuration 1
CFG2	Pin 4	Configuration 2
CFG3	Pin 5	Configuration 3
MFG1	Pin 6	Vendor Specific / Manufacturing Pin
MFG2	Pin 7	Vendor Specific / Manufacturing Pin
DEVSLP	Pin 8	Device Sleep
DA/DSS	Pin 9	Device Activity Signal / Disable Staggered Spin-Up
USER-1	Pin 10	User Optional Connection
USER-2	Pin 11	User Optional Connection
USER-3	Pin 12	User Optional Connection

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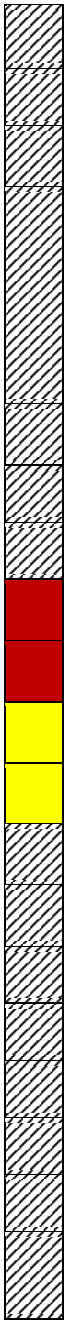
Table 4. SATA M.2 Device TPA (Receptacle) Pin Assignments

Pin Description	Connector Pin Number	Destination Number	Color ID for Data Line Polarity	Color ID for Differential Pair (Receptacle)
Configuration 3	1	CFG3	N/A	N/A
+3.3 Volts	2, 4, 70, 72, 74	+3.3V	N/A	N/A
Ground	3, 27, 33, 39, 45, 51, 57, 71, 73	GND	N/A	N/A
No connect (used for other purposes)	5, 6, 7, 8, 9, 11, 20, 22, 23, 24, 25, 26, 28, 29, 30, 31, 32, 34, 35, 36, 37, 40, 42, 44, 46, 48, 50, 52, 53, 54, 55, 59, 60, 61, 62, 63, 64, 65, 66, 67, 68	No Connect	N/A	N/A
Device Activity Signal / Disable Staggered Spin-Up	10	DA/DSS	N/A	N/A
Configuration 0	21	CFG0	N/A	N/A
Device Sleep	38	DEVSLP	N/A	N/A
Device Test Primary Transmitter Positive	41	DEVICE TB+	Red	Red Label
Device Test Transmitter Negative	43	DEVICE TB-	Black	Red Label
Device Test Receiver Negative	47	DEVICE RA-	Black	Yellow Label
Device Test Receiver Positive	49	DEVICE RA+	Red	Yellow Label
Vendor Specific / Manufacturing Pin	56	MFG1	N/A	N/A
Vendor Specific / Manufacturing Pin	58	MFG2	N/A	N/A
Configuration 1	69	CFG1	N/A	N/A
Configuration 2	75	CFG2	N/A	N/A
Optional User Access	User Opt.	USER-1	N/A	N/A
Optional User Access	User Opt.	USER-2	N/A	N/A
Optional User Access	User Opt.	USER-3	N/A	N/A
Key-B	Displaced pins: 12, 13, 14, 15, 16, 17, 18, 19			



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SATA M.2-TPA-P Cable Pinout

The SATA M.2-TPA-P cables provide four SMA connectors (one lane of primary differential TA and RB). Labels clearly mark each cable or connector. The following figure refers to the pin-description table for the plug connector.

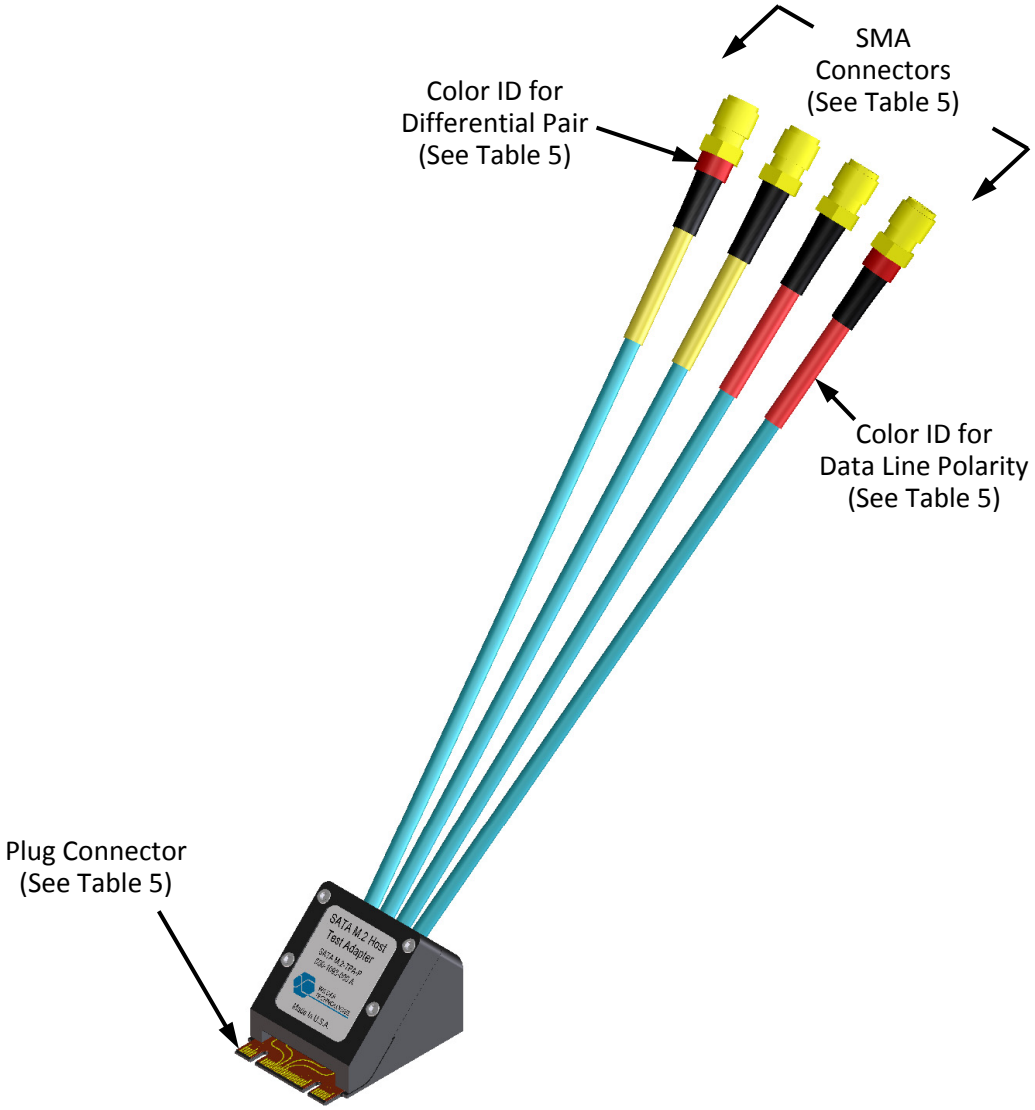

Figure 5. Cable Connectors (SATA M.2-TPA-P shown)

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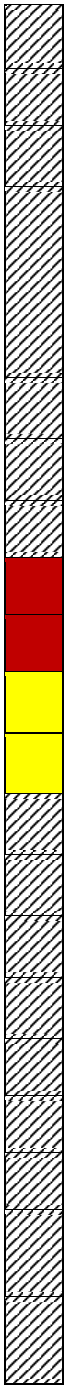
Table 5 SATA M.2 Host TPA (Plug) Pin Assignments

Pin Description	Connector Pin Number	Destination Number	Color ID for Data Line Polarity	Color ID for Differential Pair (Receptacle)
Configuration 3, connected to Ground	1	CFG3	N/A	N/A
+3.3 Volts	2, 4, 70, 72, 74	+3.3V	N/A	N/A
Ground	3, 27, 33, 39, 45, 51, 57, 71, 73	GND	N/A	N/A
No connect (used for other purposes)	5, 6, 7, 8, 9, 11, 20, 22, 23, 24, 25, 26, 28, 29, 30, 31, 32, 34, 35, 36, 37, 40, 42, 44, 46, 48, 50, 52, 53, 54, 55, 67, 68	No Connect	N/A	N/A
Device Activity Signal / Disable Staggered Spin-Up	10	DA/DSS	N/A	N/A
Configuration 0, connected to Ground	21	CFG0	N/A	N/A
Device Sleep	38	DEVSLP	N/A	N/A
Host Test Receiver Positive	41	HOST RB+	Red	Red Label
Host Test Receiver Negative	43	HOST RB-	Black	Red Label
Host Test Transmitter Negative	47	HOST TA-	Black	Yellow Label
Host Test Transmitter Positive	49	HOST TA+	Red	Yellow Label
Vendor Specific / Manufacturing Pin	56	MFG1	N/A	N/A
Vendor Specific / Manufacturing Pin	58	MFG2	N/A	N/A
Configuration 1, connected to Ground	69	CFG1	N/A	N/A
Configuration 2, connected to Ground	75	CFG2	N/A	N/A
Optional User Access	User Opt.	USER-1	N/A	N/A
Optional User Access	User Opt.	USER-2	N/A	N/A
Optional User Access	User Opt.	USER-3	N/A	N/A
Slot-B (notch)	Displaced pins: 12, 13, 14, 15, 16, 17, 18, 19			
Slot-M (notch)	Displaced pins: 59, 60, 61, 62, 63, 64, 65, 66			



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Electrical Specifications

NOTE: All specifications in this manual are subject to change.

Table 6. Electrical Specifications

SPECIFICATION	MINIMUM	TYPICAL	MAXIMUM	NOTES
Insertion Loss (GHz), at -3 db	18	22.2		2X-THRU with six-inch cables
Return Loss (GHz), at -20 db	10	14.9		2X-THRU with six-inch cables
Insertion Loss (GHz), at -3 db		>26.5		1X-THRU with three-inch cables
Return Loss (GHz), at -20 db		7.2		1X-THRU with three-inch cables
VSWR, at 10 GHz	1.21:1			2X-THRU with six-inch cables
Differential Impedance (ohms), 100 ps Rise Time	95		105	All Differential Pairs, Device TPA and Host TPA, excluding SATA M.2 connector.
Differential Impedance (ohms), 100 ps Rise Time	85		115	All Differential Pairs, Device TPA and Host TPA, including SATA M.2 connector.
Impedance (ohms), 100 ps Rise Time	47.5		52.5	All Differential Pairs, Device TPA and Host TPA, excluding SATA M.2 connector.
Impedance (ohms), 100 ps Rise Time	47.5		52.5	SHORT, OPEN, LOAD, 1X-THRU, and 2X-THRU
Intra-pair Skew (ps)	-6		6	All Differential Pairs, Device TPA and Host TPA
Inter-pair Skew (ps)	-6		6	All Differential Pairs, Device TPA and Host TPA
NEXT (db), at 8 GHz	-40			All differential pairs, single aggressor, without SATA M.2 connector, with six-inch cables and terminations
Current Carrying (A)	1.0			+3.3V Power

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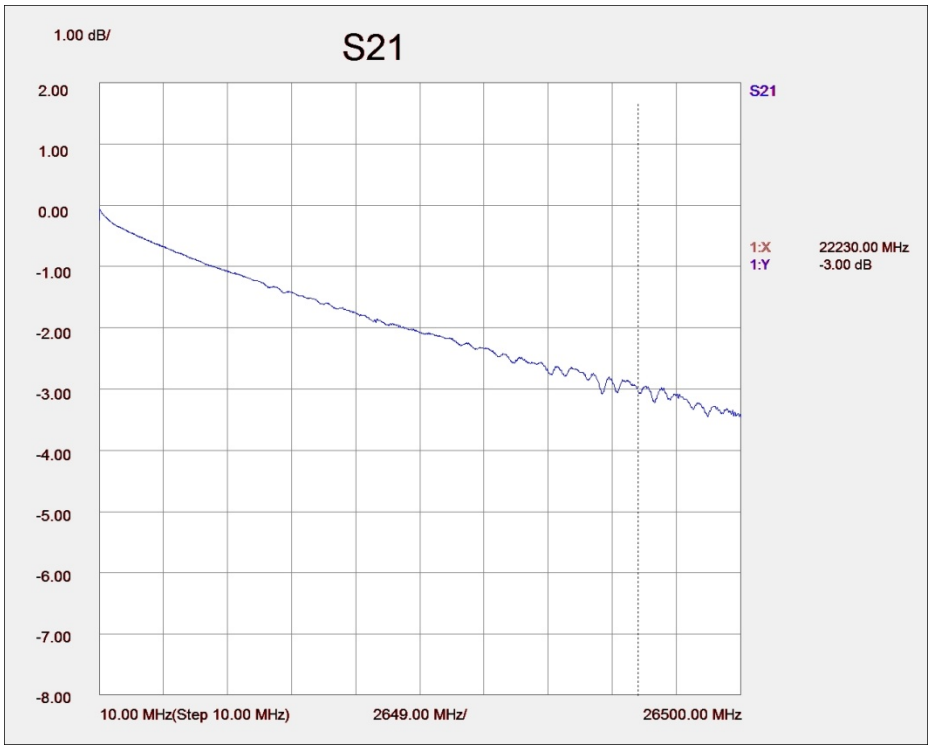

Figure 6. Typical 2X-THRU insertion loss

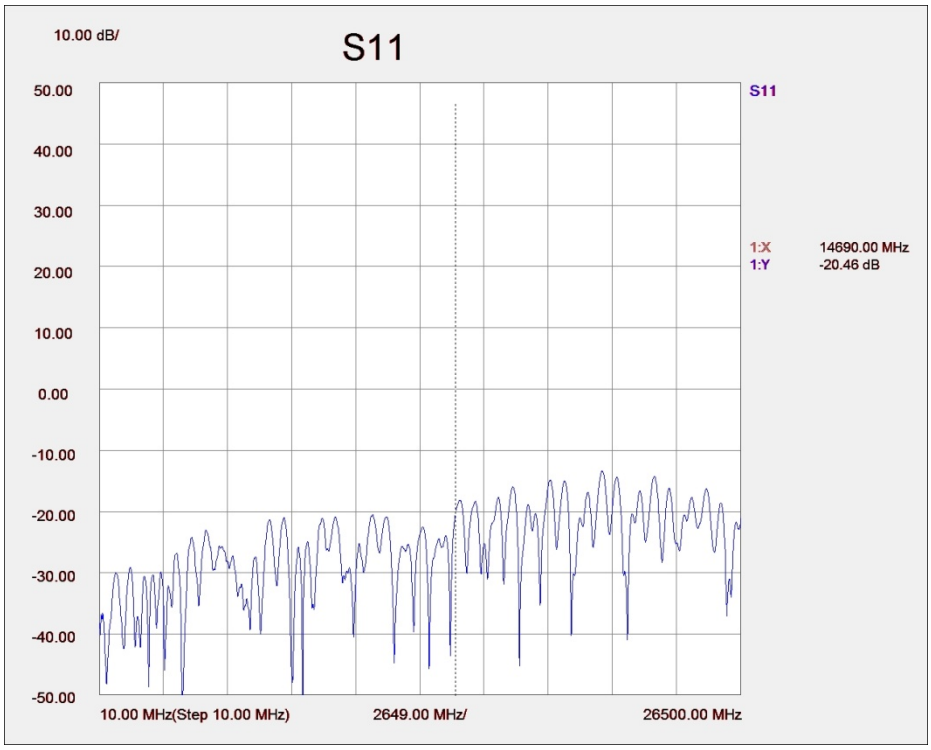

Figure 7. Typical 2X-THRU return loss

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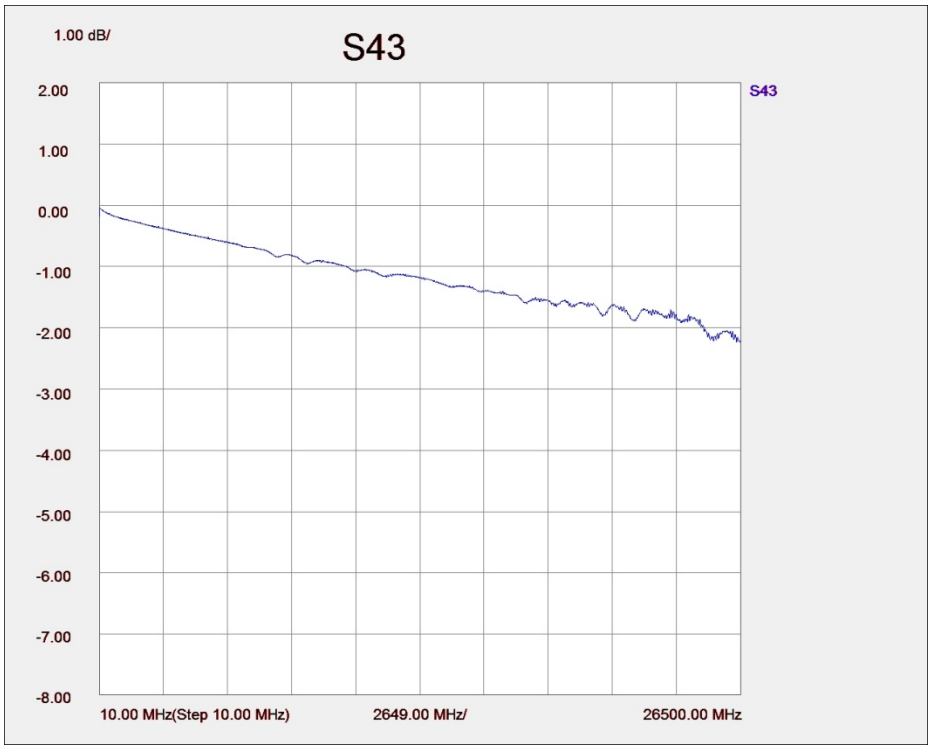

Figure 8. Typical 1X-THRU insertion loss

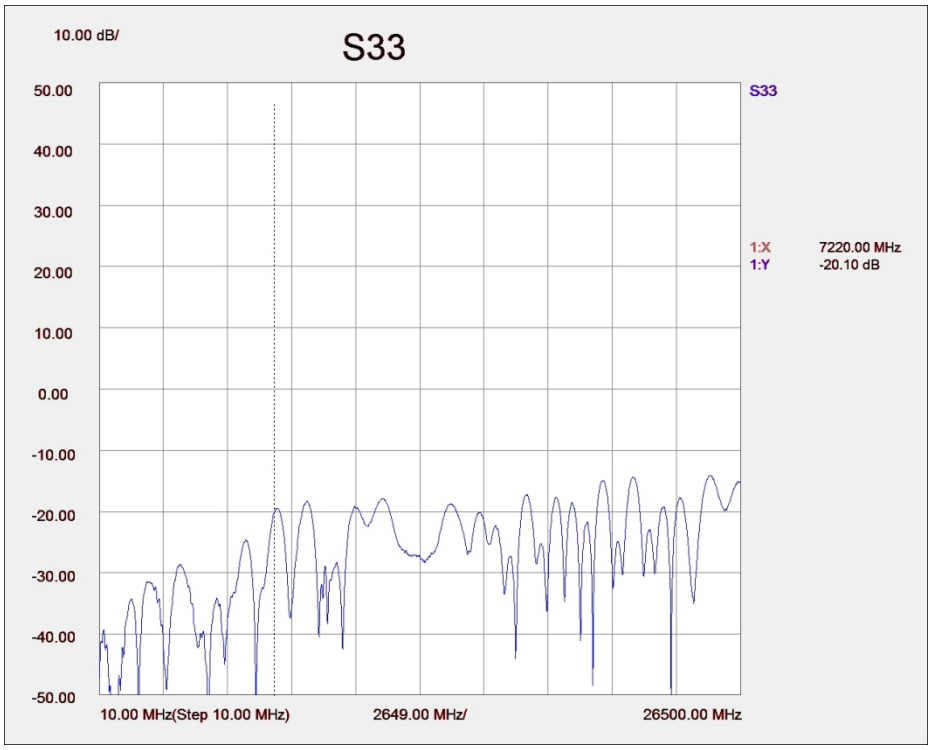

Figure 9. Typical 1X-THRU return loss

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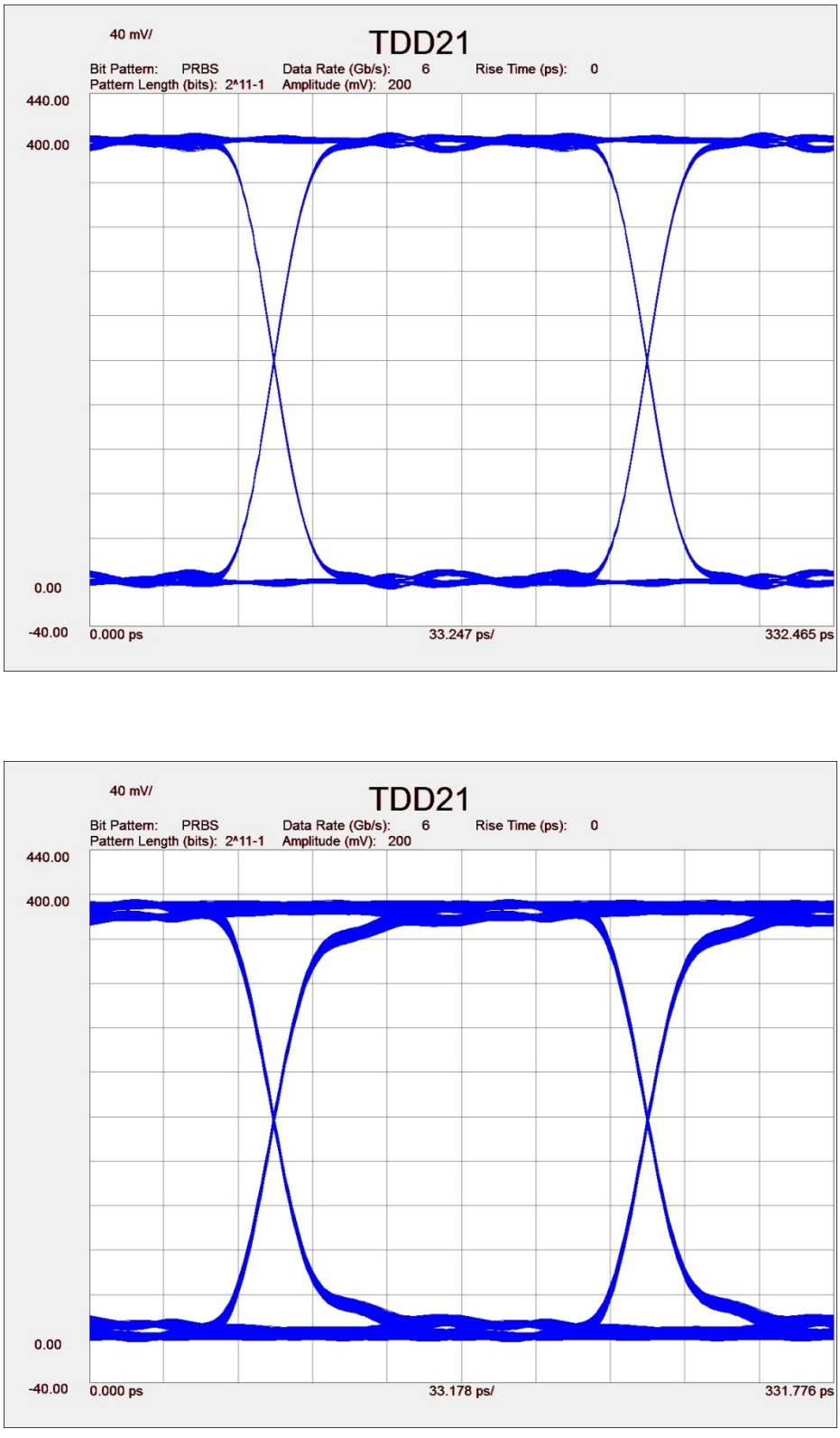

Figure 10. Typical mated pair 6 Gb/s eye diagram, with calibration (top) and without calibration (bottom)

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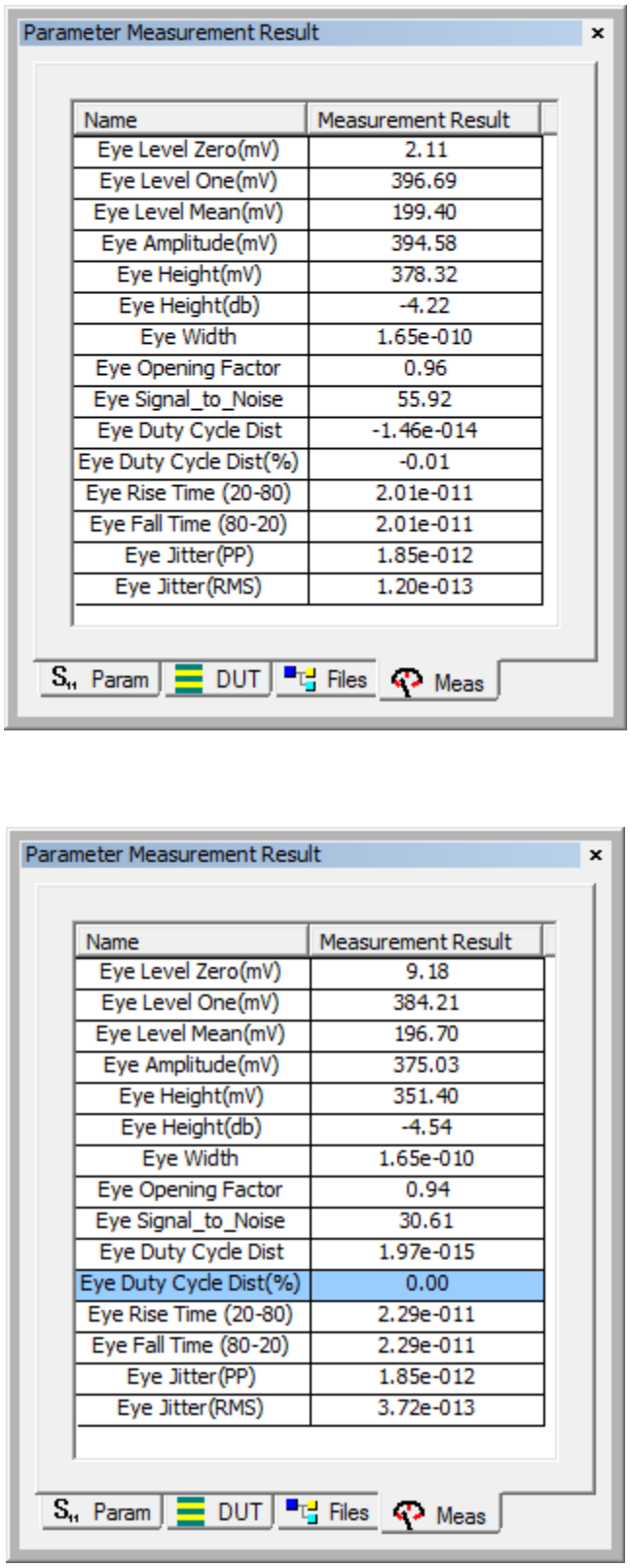

Figure 11. Typical mated pair 6 Gb/s eye data, with calibration (top) and without calibration (bottom)

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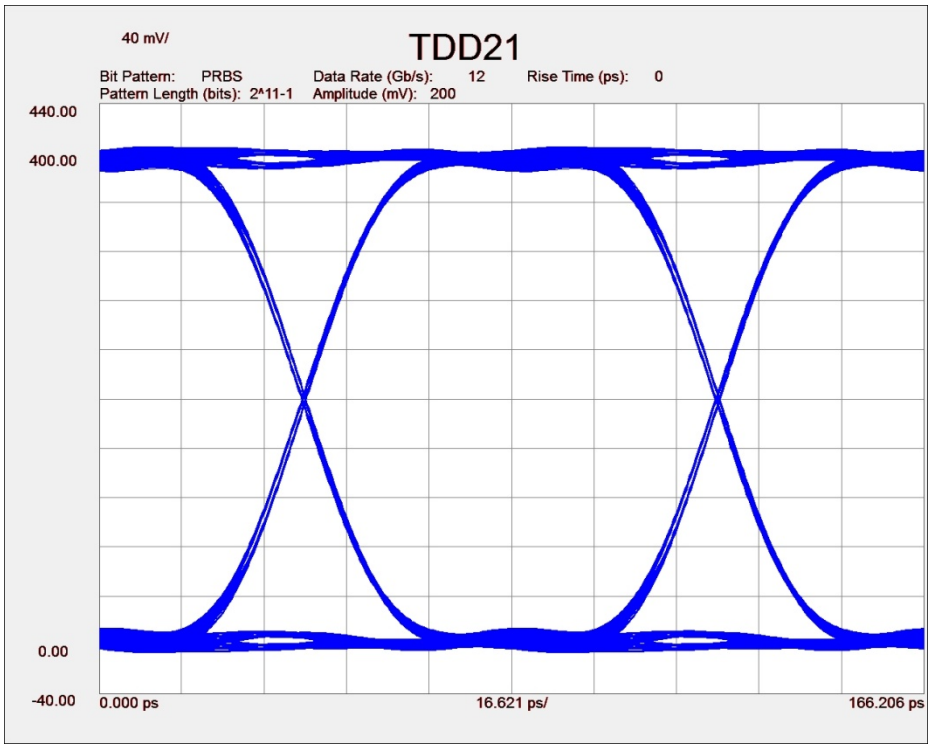

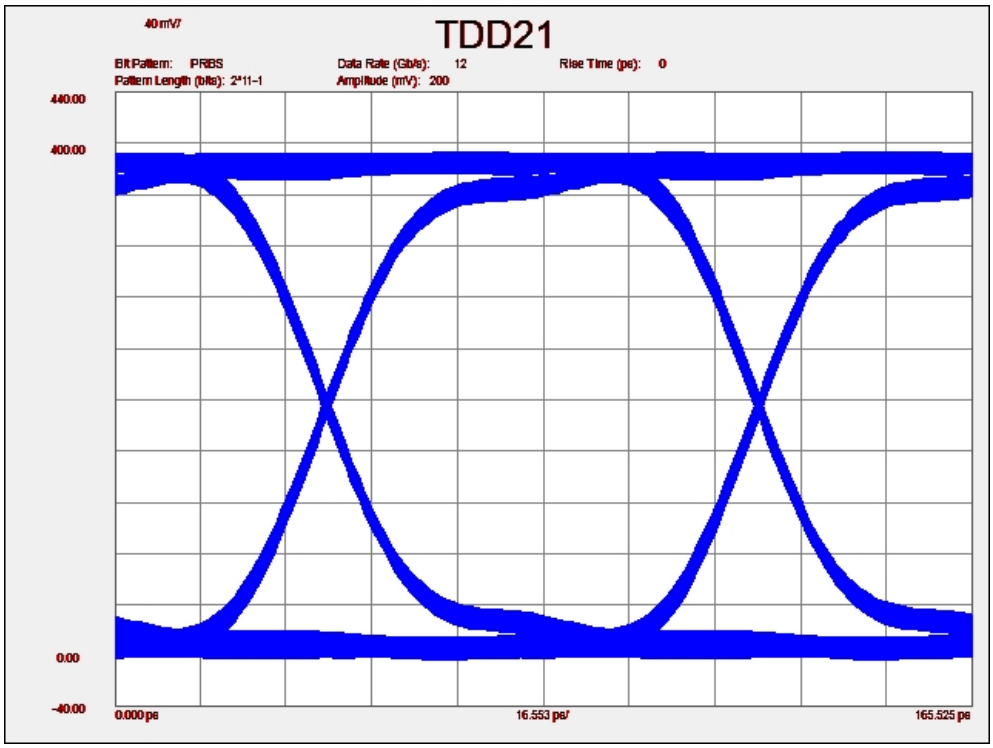

Figure 12. Typical mated pair 12 Gb/s eye diagram, with calibration (top) and without calibration (bottom)

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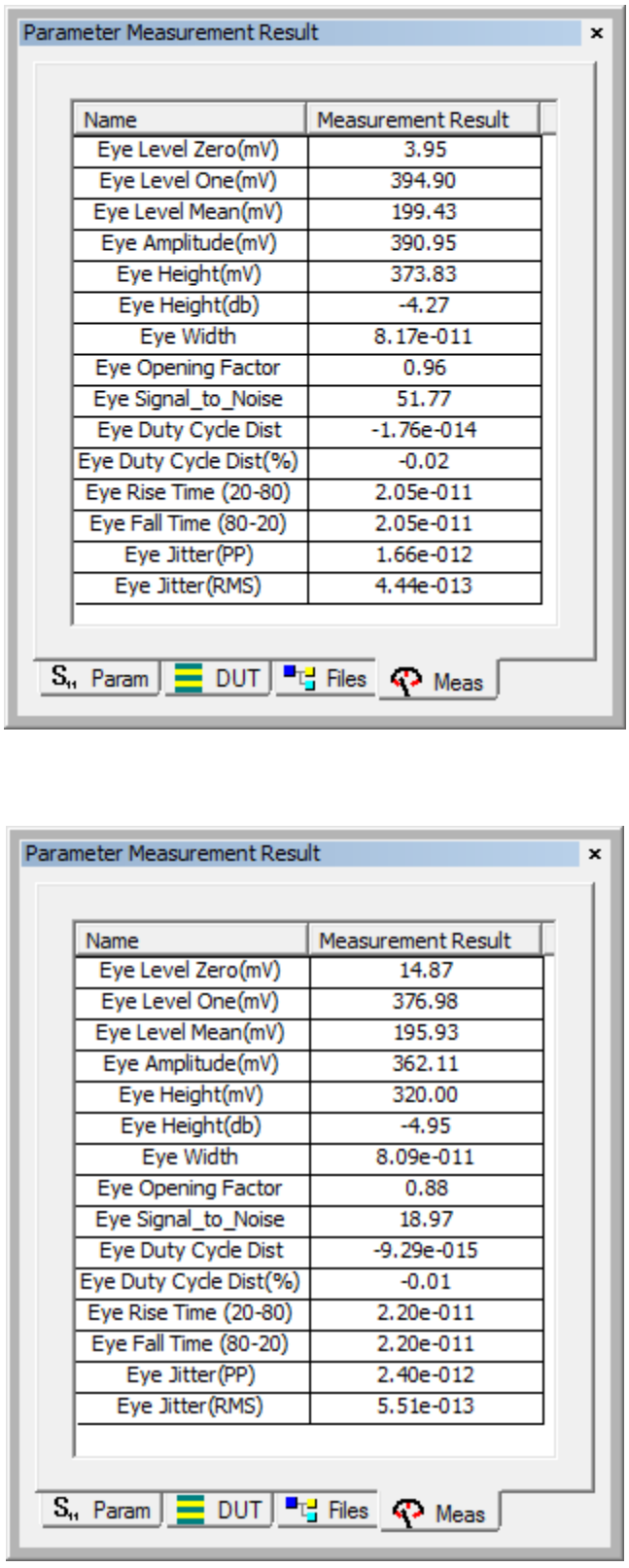

Figure 13. Typical mated pair 12 Gb/s eye data, with calibration (top) and without calibration (bottom)

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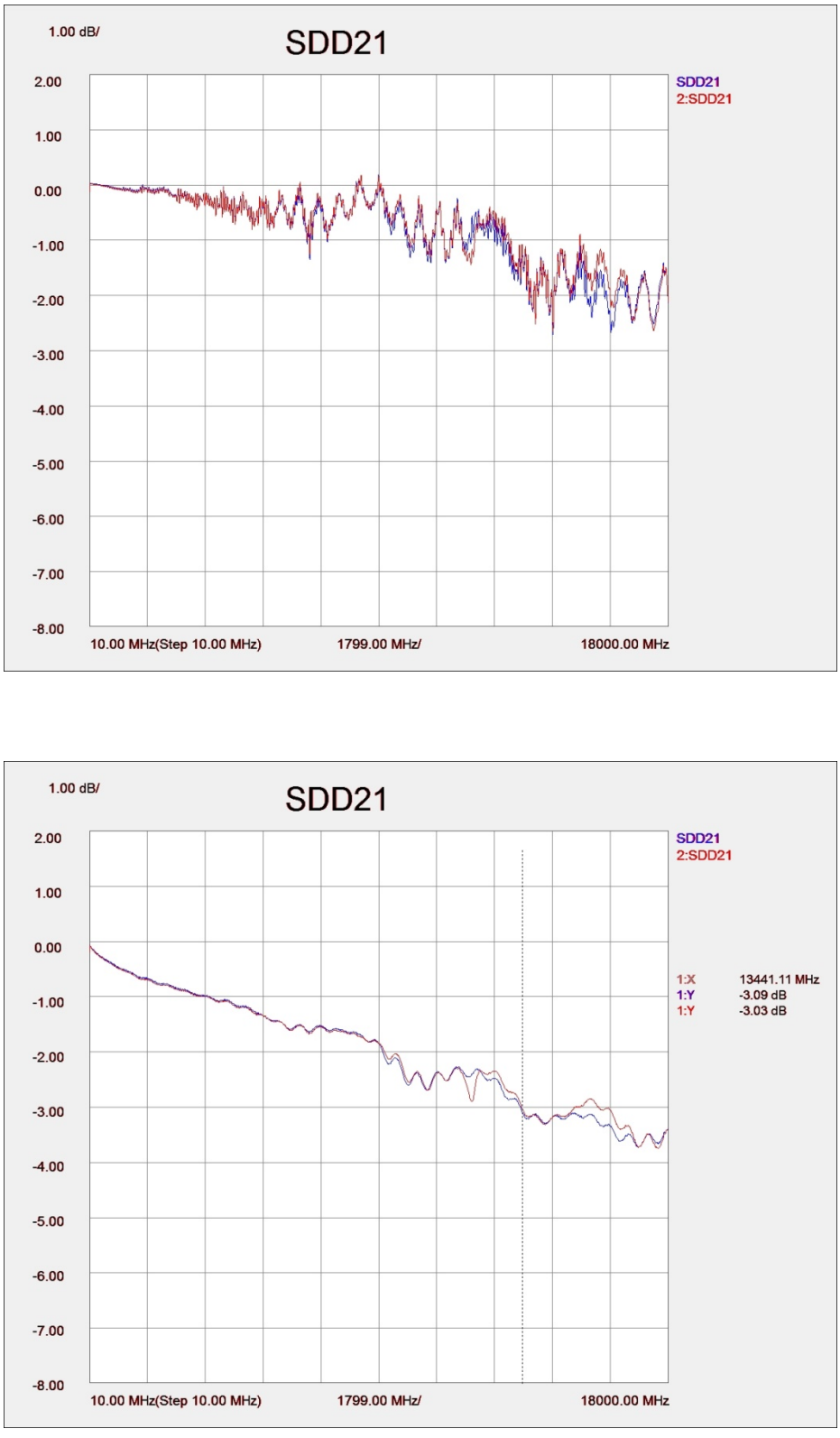

Figure 14. Typical mated pair balanced insertion loss, with calibration (top) and without calibration (bottom)

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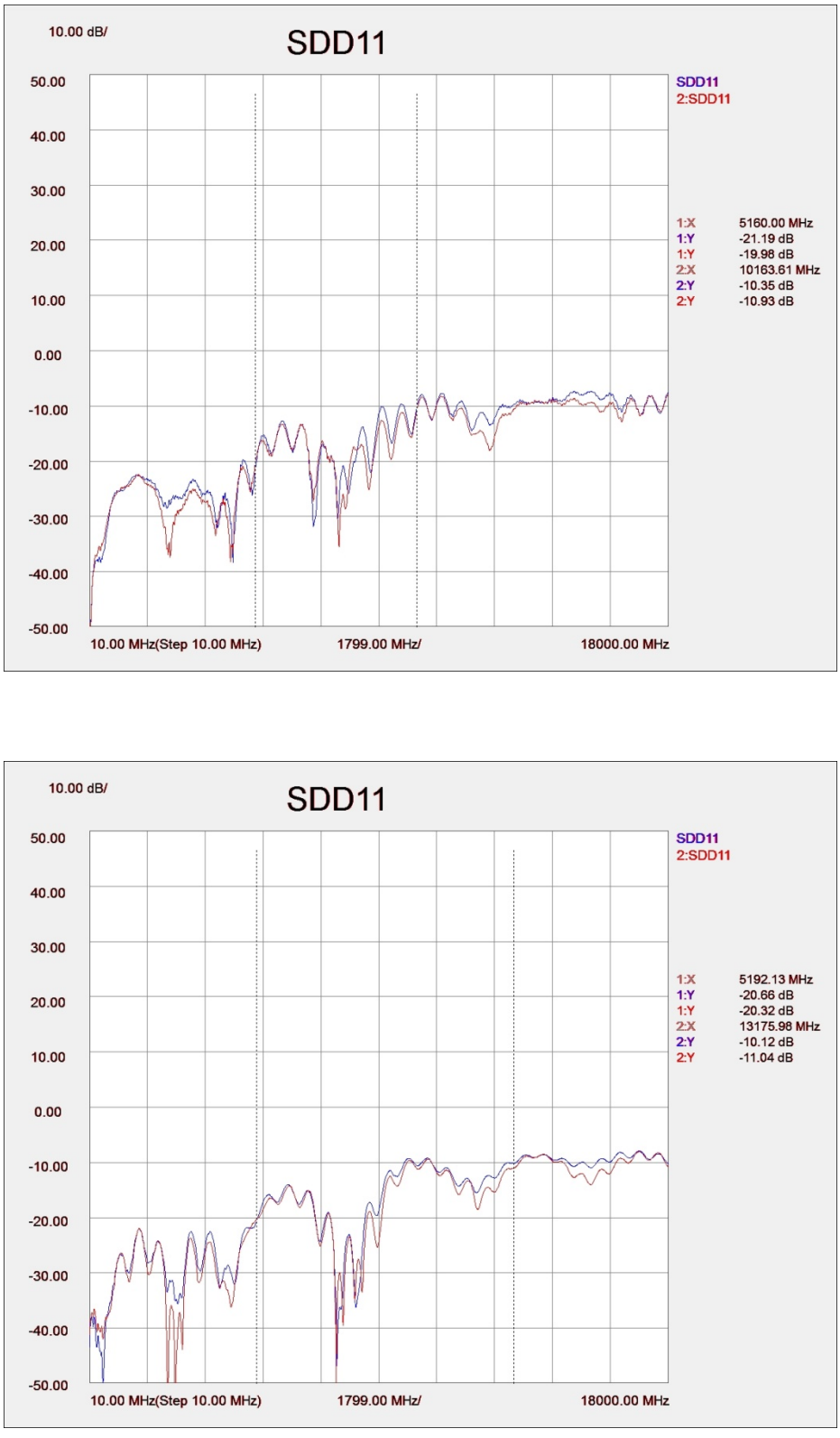

Figure 15. Typical mated pair balanced return loss, with calibration (top) and without calibration (bottom)

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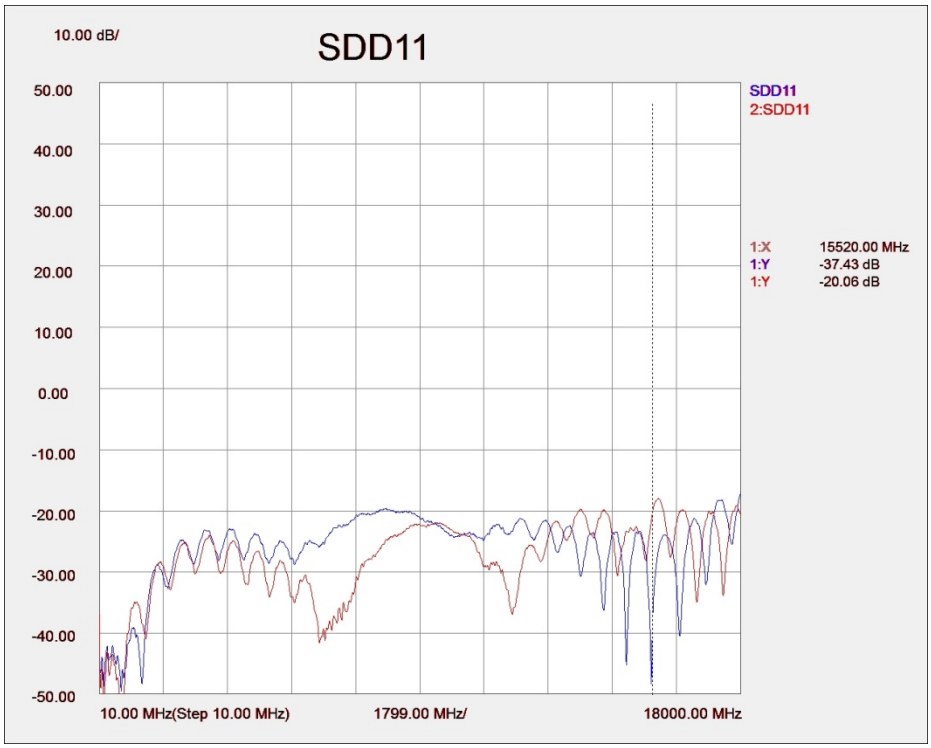

Figure 16. Typical TPA balanced return loss, differential termination replacing connector

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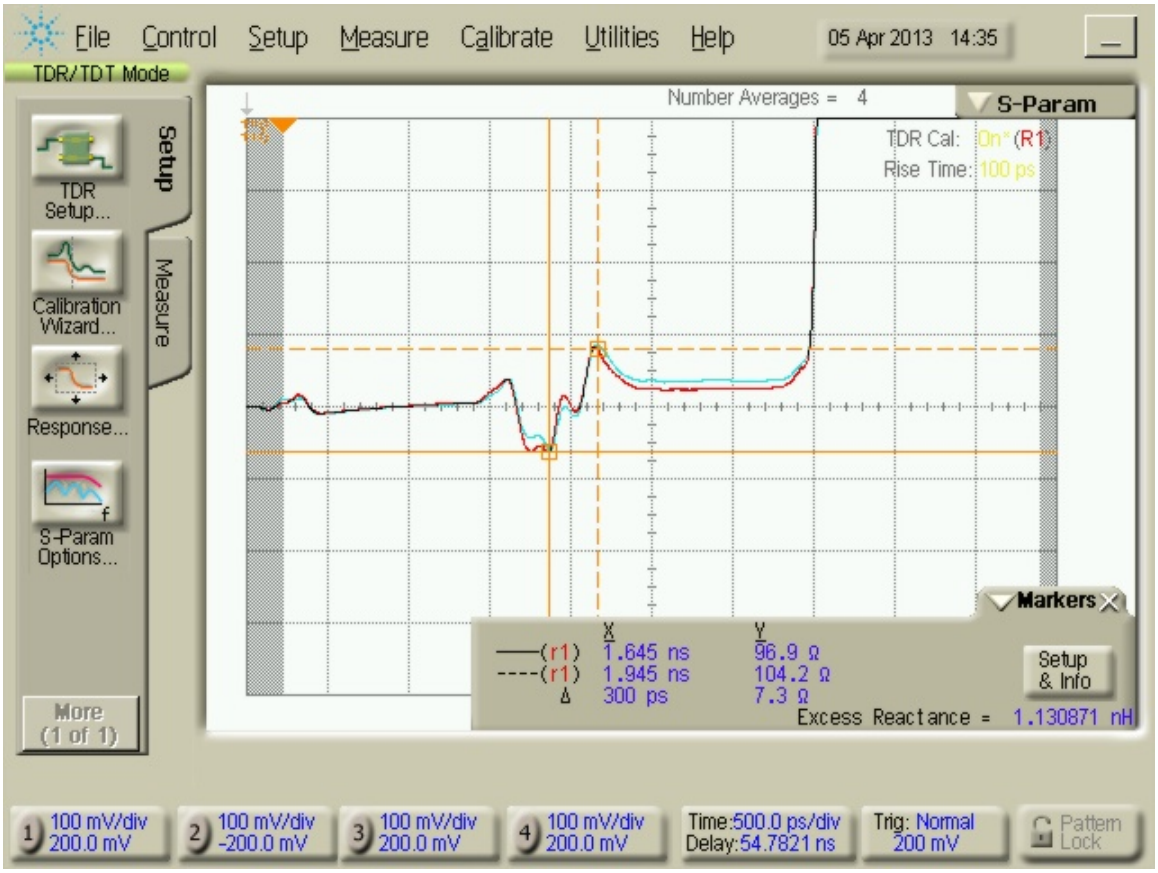

Figure 17. Typical differential TDP of TPA-P connected to TPA-R at 100 ps Rise Time, All differential pairs. (Equivalent to 70ps, 20% to 80%.)

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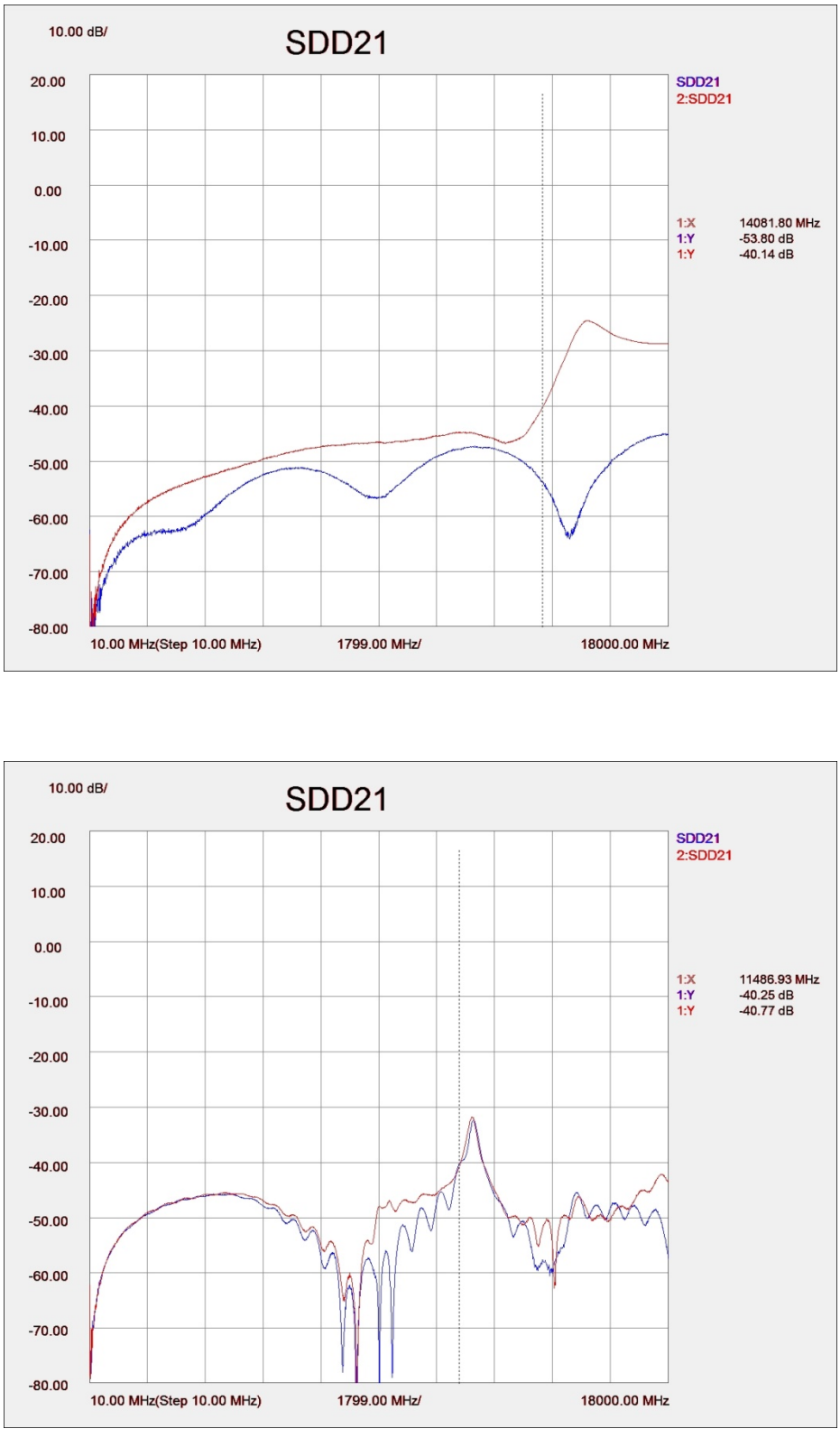

Figure 18. Typical Differential NEXT, without connector (top) and with mated connectors (bottom), adjacent differential pairs, all differential pairs terminated at both ends

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SATA M.2 TPA Optional Accessories

SATA M.2-TPA-R Optional Accessories

The SATA M.2-TPA-R (Device TPA) can optionally be supplied with Device Support Adapter materials that allow the user to properly retain and stabilize a device under test. Wilder Technologies part number 600-1097-000 may be ordered separately for this purpose.

The figure, below, illustrates the installation and a typical application of the optional Device Support Adapter materials.

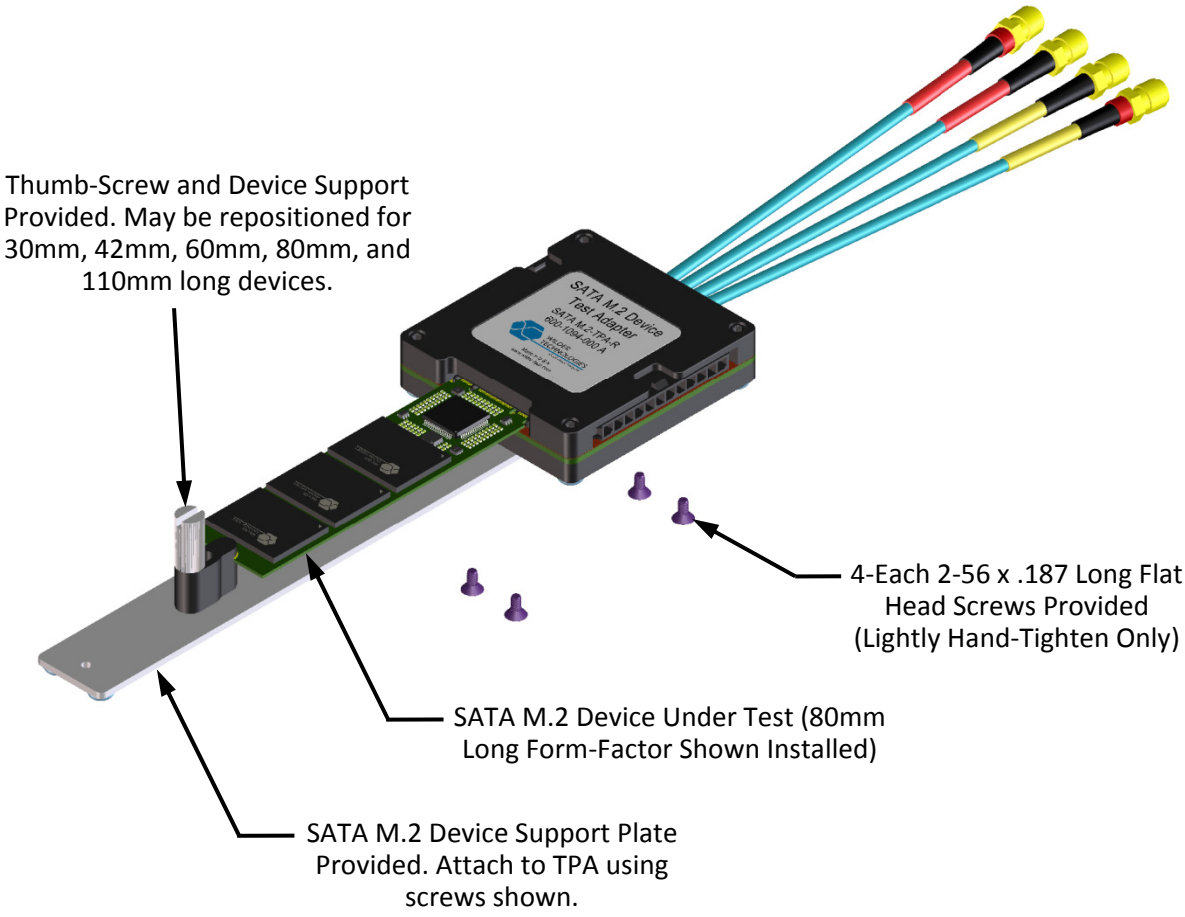
Thumb-Screw and Device Support Provided. May be repositioned for 30mm, 42mm, 60mm, 80mm, and 110mm long devices.
4-Each 2-56 x .187 Long Flat Head Screws Provided (Lightly Hand-Tighten Only)
SATA M.2 Device Under Test (80mm Long Form-Factor Shown Installed)
SATA M.2 Device Support Plate Provided. Attach to TPA using screws shown.

Figure 19. SATA M.2-TPA-R Device Support Adapter

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SATA M.2-TPA-P Optional Accessories

The SATA M.2-TPA-P (Host TPA) can be optionally supplied with Host TPA Length Adapter materials. These materials allow the user to properly retain and stabilize the SATA M.2 Host TPA when installed in host systems that are designed to accept devices with overall lengths of 42mm, 60mm, 80mm, or 110mm. The table below indicates the Wilder Technologies part numbers for an optional complete kit of length adapters and part numbers for individual specific length adapters.

Table 7. Optional SATA M.2 Host TPA Length Adapters

WILDER TECHNOLOGIES PART NUMBER	DESCRIPTION
600-1096-000	Complete Kit – Contains Adapters for 42mm, 60mm, 80mm, 110mm, and Hardware
600-1096-042	Contains Adapter for 42mm Applications and Mounting Hardware
600-1096-060	Contains Adapter for 60mm Applications and Mounting Hardware
600-1096-080	Contains Adapter for 80mm Applications and Mounting Hardware
600-1096-110	Contains Adapter for 110mm Applications and Mounting Hardware

The figure, below, illustrates the installation and typical application of the optional Host Length Adapter materials.

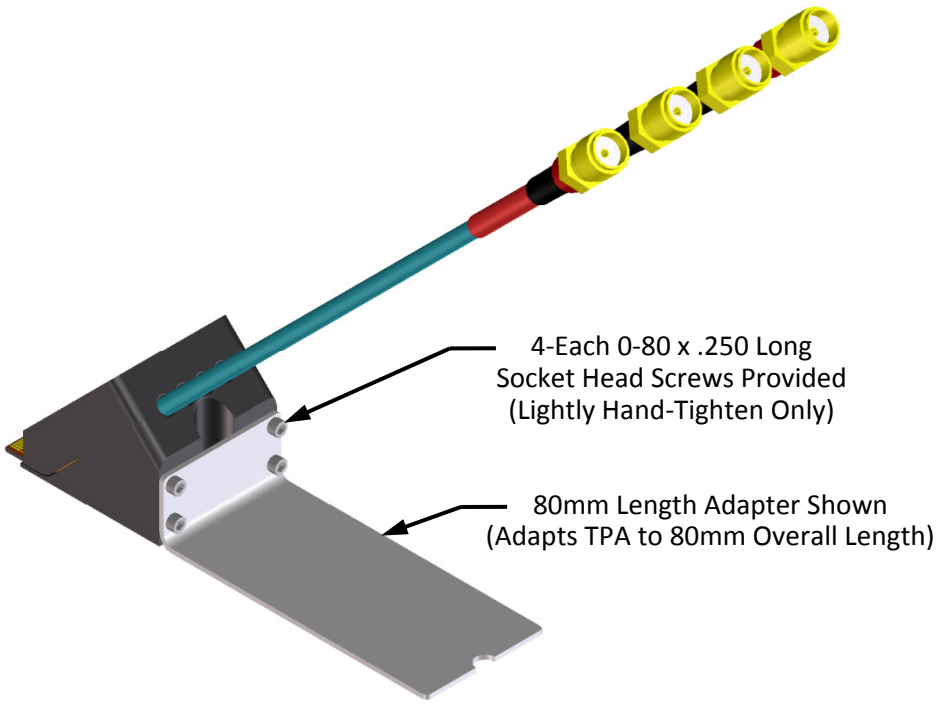
4-Each 0-80 x .250 Long
Socket Head Screws Provided
(Lightly Hand-Tighten Only)
80mm Length Adapter Shown
(Adapts TPA to 80mm Overall Length)

Figure 20. SATA M.2-TPA-P Device Length Adapter

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Wilder Technologies, LLC – Limited Warranty

Wilder Technologies, LLC warrants that each Test Adapter, 1) is free from defects in materials and workmanship and, 2) conforms to Wilder Technologies specifications for a period of 12 months. **See Consumable and Fragile Material Warranty for exceptions to the 12 month warranty**

The warranty period for a Test Adapter is a specified, fixed period commencing on the date of ship from Wilder Technologies, LLC. If you did not purchase your Test Adapter directly from Wilder Technologies, LLC, the serial number and a valid proof of purchase will be required to establish your purchase date. If you do not have a valid proof of purchase, the warranty period will be measured from the date of ship from Wilder Technologies, LLC.

If, during the warranty period, the Test Adapter is not in good working order, Wilder Technologies, LLC will, at its option, repair or replace it at no additional charge, except as is set forth below. In some cases, the replacement Test Adapter may not be new and may have been previously installed. Regardless of the Test Adapter's production status, Wilder Technologies, LLC appropriate warranty terms apply.

Consumable and Fragile Material Warranty
Wilder Technologies, LLC warrants that consumable materials and all fragile materials supplied by Wilder Technologies, LLC either as part of an instrument or system, or supplied separately, will be free from defects in material and workmanship at the time of shipment.

Extent of Warranty
The warranty does not cover the repair or exchange of a Test Adapter resulting from misuse, accident, modification, unsuitable physical or operating environment, improper maintenance by you, or failure caused by a product for which Wilder Technologies, LLC is not responsible. The warranty is voided by removal or alteration of Test Adapter or parts identification labels. The initial three months are unconditional; the remaining months excludes plugs, receptacles and SMA connectors. Connectors are wear items and excluded from the warranty after the initial three months.

These warranties are your exclusive warranties and replace all other warranties or conditions, express or implied, including but not limited to, the implied warranties or conditions or merchantability and fitness for a particular purpose. These warranties give you specific legal rights and you may also have other rights which vary from jurisdiction to jurisdiction. Some jurisdictions do not allow the exclusion or limitation of express or implied warranties, so the above exclusion or limitation may not apply to you. In that event, such warranties are limited in duration to the warranty period. No warranties apply after that period.

Items Not Covered by Warranty
Wilder Technologies, LLC does not warrant uninterrupted or error–free operation of a Test Adapter.

Any technical or other support provided for a Test Adapter under warranty, such as assistance via telephone with "how–to" questions and those regarding Test Adapter set-up and installation, will be provided **WITHOUT WARRANTIES OF ANY KIND**.

Warranty Service
Warranty service may be obtained from Wilder Technologies, LLC by returning a Wilder Technologies, LLC Returns Material Authorization and the Test Adapter to Wilder Technologies, LLC during the warranty period. To obtain RMA number, contact support@wilder-tech.com.

You may be required to present proof of purchase or other similar proof of warranty entitlement. You are responsible for any associated transportation charges, duties and insurance between you and Wilder Technologies, LLC. In all instances, you must ship Test Adapters in Wilder Technologies, LLC approved packaging. Information on packaging guidelines can be found at: www.wilder-tech.com. Wilder Technologies, LLC will ship repaired or replacement Test Adapter Delivery Duty Prepaid (DDP) and will pay for return shipment. You will receive title to the repaired or replacement Test Adapter and you will be the importer of record.

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Wilder Technologies, LLC – Terms & Conditions of Sale

1. **Other Documents:** This Agreement may NOT be altered, supplemented, or amended by the use of any other document(s) unless otherwise agreed to in a written agreement signed by both you and Wilder Technologies, LLC. If you do not receive an invoice or acknowledgement in the mail, via e-mail, or with your Product, information about your purchase may be obtained at support@wilder-tech.com or by contacting your sales representative.

2. **Payment Terms, Orders, Quotes, Interest:** Terms of payment are within Wilder Technologies, LLC's sole discretion, and unless otherwise agreed to by Wilder Technologies, LLC, payment must be received by Wilder Technologies, LLC prior to Wilder Technologies, LLC's acceptance of an order. Payment for the products will be made by credit card, wire transfer, or some other prearranged payment method unless credit terms have been agreed to by Wilder Technologies, LLC. Invoices are due and payable within the time period noted on your invoice, measured from the date of the invoice. Wilder Technologies, LLC may invoice parts of an order separately. Your order is subject to cancellation by Wilder Technologies, LLC, in Wilder Technologies, LLC's sole discretion. Unless you and Wilder Technologies, LLC have agreed to a different discount, Wilder Technologies, LLC's standard pricing policy for Wilder Technologies, LLC-branded systems, which includes hardware, software and services in one discounted price, allocates the discount off list price applicable to the service portion of the system to be equal to the overall calculated percentage discount off list price on the entire system. Wilder Technologies, LLC is not responsible for pricing, typographical, or other errors in any offer by Wilder Technologies, LLC and reserves the right to cancel any orders resulting from such errors.

3. **Shipping Charges; Taxes; Title; Risk of Loss:** Shipping, handling, duties and tariffs are additional unless otherwise expressly indicated at the time of sale. Title to products passes from Wilder Technologies, LLC to Customer on shipment from Wilder Technologies, LLC's facility. Loss or damage that occurs during shipping by a carrier selected by Wilder Technologies, LLC is Wilder Technologies, LLC's responsibility. Loss or damage that occurs during shipping by a carrier selected by you is your responsibility. You must notify Wilder Technologies, LLC within 7 days of the date of your invoice or acknowledgement if you believe any part of your purchase is missing, wrong or damaged. Unless you provide Wilder Technologies, LLC with a valid and correct tax exemption certificate applicable to your purchase of Product and the Product ship-to location, you are responsible for sales and other taxes associated with the order. **Shipping dates are estimates only**.

4. **WARRANTY:** WILDER TECHNOLOGIES, LLC, warrants that the item(s) manufactured under the Buyer's contract shall be free from defects in materials and workmanship furnished by WILDER TECHNOLOGIES, LLC, and shall conform to the applicable drawings and specifications. WILDER TECHNOLOGIES, LLC'S liability herein, for breach of warranty, contract or negligence in manufacturing, shall be limited to repair or replacement. Repair or replacement of defective items will be applicable only if the Buyer notifies WILDER TECHNOLOGIES, LLC, by written notice within 30-days of delivery. All claims shall be addressed to: support@wilder-tech.com or WILDER TECHNOLOGIES, LLC, 6101A East 18th Street, Vancouver, Washington 98661 U.S.A.; ATTENTION: Customer Service Manager. WILDER TECHNOLOGIES, LLC, reserves the right to inspect at the Buyer's plant all items claimed to be defective or nonconforming prior to authorizing their return. WILDER TECHNOLOGIES, LLC, assumes no liability for the results of the use of its components in conjunction with other electric, electronic or mechanical components, circuits and/or systems. The foregoing constitutes the sole and exclusive remedy of the Buyer and the exclusive liability of WILDER TECHNOLOGIES, LLC, and is IN LIEU OF ANY AND ALL OTHER WARRANTIES, STATUTORY, IMPLIED OR EXPRESSED AS TO MERCHANTABILITY, FITNESS FOR THE PURPOSE SOLD, DESCRIPTION, QUALITY, and PRODUCTIVENESS OR ANY OTHER MATTER. Without limiting the foregoing, in no event shall WILDER TECHNOLOGIES, LLC, be liable for loss of use, profit or other collateral, or for special and/or consequential damages.

5. **RETURNED GOODS:** WILDER TECHNOLOGIES, LLC, will accept only those goods for return that have been authorized for return. All goods authorized for return shall be assigned a Returned Material Authorization (RMA) Number. The RMA Number shall be clearly marked on the shipping container(s) and all documentation accompanying the goods authorized for return. The RMA Number shall be assigned by WILDER TECHNOLOGIES, LLC pursuant to the conditions set forth in Paragraph 4, WARRANTY.

6. **UNITED STATES GOVERNMENT CONTRACTS:** In the event this offer is accepted under Government contract, WILDER TECHNOLOGIES, LLC, agrees to accept clauses required by Government regulations and to waive WILDER TECHNOLOGIES, LLC conditions inconsistent therewith. WILDER TECHNOLOGIES, LLC, certifies that it is a regular manufacturer or dealer of the goods and/or services offered herein and that the prices offered do not exceed those charged to any customer for like quantities, services or materials under the same conditions.

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Compliance with Environmental Legislation

Wilder Technologies, LLC, is dedicated to complying with the requirements of all applicable environmental legislation and regulations, including appropriate recycling and/or disposal of our products.

WEEE Compliance Statement

The European Union adopted Directive 2002/96/EC on Waste Electrical and Electronic Equipment (WEEE), with requirements that went into effect August 13, 2005. WEEE is intended to reduce the disposal of waste from electrical and electronic equipment by establishing guidelines for prevention, reuse, recycling and recovery.

Wilder Technologies has practices and processes in place to conform to the requirements in this important Directive.

In support of our environmental goals, effective January 1st, 2009 Wilder Technologies, LLC has partnered with E-Tech Recycling of Beaverton, Oregon, www.etechrecycling.com, to recycle our obsolete and electronic waste in accordance with the European Union Directive 2002/96/EC on waste electrical and electronic equipment ("WEEE Directive").

As a service to our customers, Wilder Technologies is also available for managing the proper recycling and/or disposal of all Wilder Technologies products that have reached the end of their useful life. For further information and return instructions, contact support@wilder-tech.com.

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Glossary of Terms

TERMINOLOGY	DEFINITION
Aggressor	A signal imposed on a system (i.e., cable assembly) to measure response on other signal carriers.
Decibel (dB)	Ten times the common logarithm (i.e. log10) of the ratio of relative powers.
Informative	The designation of a test that is not required for compliance but is considered important from a characterization standpoint. It is provided for informational purposes only.
Insertion loss	The ratio, expressed in dB, of incident power to delivered power.
SATA M.2-TPA	SATA M.2 Test Point Access. A specialized assembly that interfaces to an SATA M.2 receptacle or plug and enables access of signals for measurement or stimulation.
Near-end crosstalk	Crosstalk that is propagated in a disturbed channel in the opposite direction as the propagation of a signal in the aggressor channel. The terminals of the aggressor channel and the victim channel are usually close to each other.
Normative	The designation of a test that is required for compliance.
Return Loss	The ratio, expressed in dB, of incident power to reflected power.
SATA Initiator Device	A device containing SSP, STP, and /or SMP initiating ports in a SATA domain.
SATA Link	The SATA link is a full duplex point to point link as continuous data activity exists on each direction. For purposes of compliance testing of Hosts and Devices, the full duplex link is broken into two simplex links, one for the Host transmitting to the Device and the other for the Device transmitting to the Host. Each link is tested for compliance separately.
SATA Target Device	A device containing SSP, STP, and /or SMP target ports in a SATA domain.
Serial ATA (SATA)	The protocol defined by SATA (see ATA8-AAM)
Serial Attached SCSI (SAS)	The set of protocols defined in SPL and the interconnect defined by the SAS-2.1 standard.
Victim	A signal carrier on a system that has a response imposed on it by other signals in the system.

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Visit our website at www.wilder-tech.com

Wilder Technologies, LLC
6101A East 18th Street
Vancouver, WA 98661
Phone: 360-859-3041
Fax: 360-859-3105
www.wilder-tech.com

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